

Ranking Methodologies

(and a few extra bits)

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This is where I started...

The image shows a mobile application interface for searching and navigating to Coventry. On the left, a search bar contains the text "coventry". Below it is a large photograph of a Gothic cathedral. A blue banner below the photo displays the text "Coventry", a weather icon, "Partly Cloudy · 8°C", and the time "11:59 AM". To the right of the banner is a "Directions" button with a blue location pin icon. Below the banner are four icons with labels: "SAVE", "NEARBY", "SEND TO YOUR PHONE", and "SHARE". At the bottom left, there is a "Photos" section with two thumbnail images. Below that is a "Quick facts" section with the text "Coventry is a city in central England. It's known for the". On the right side of the interface is a map of the region around Birmingham and Coventry. A red location pin is placed on Coventry. A purple circle with a white location pin icon is overlaid on the map near Meltor Mowbray. The map shows major roads like the M6 and M1, and various towns and villages. At the bottom of the map, there is a "Satellite" view button and a scale bar indicating 20 km. The Google logo and "Map data ©2018 Google" are visible at the bottom of the map.

...then I lived here...

Fort Portal, Uganda

Fort Portal
Uganda

Rain · 24°C
3:04 PM

Directions

SAVE NEARBY SEND TO YOUR PHONE SHARE

Photos

Quick facts

Map data ©2018 Google, ORION-ME United Kingdom Terms 1000 km
Send feedback

...and here...

The image shows a mobile search results page for 'Oxford'. The top section features a search bar with 'Oxford' entered, a magnifying glass icon, and a close button. Below the search bar is a large image of a historic Oxford building. A blue banner below the image displays 'Oxford' in white text, a weather icon (sun), 'Sunny · 11°C', '12:05 PM', and a 'Directions' button with a blue location pin icon. Below the banner are four icons: a bookmark icon labeled 'SAVE', a location pin icon labeled 'NEARBY', a smartphone icon labeled 'SEND TO YOUR PHONE', and a share icon labeled 'SHARE'. Below these icons are two photo thumbnails: one of a building and one of a canal. A 'Quick facts' section follows, with the text 'Oxford, a city in central southern England, revolves around its'. To the right of the search results is a map of Oxford, showing the city center with a red location pin. The map includes labels for various areas like Woodstock, Bladon, Kidlington, Yarnton, Godstow, Sandford-on-Thames, and Abingdon. Major roads like the M40 and A44 are also visible. The map has a scale bar for 5 km and a 'Satellite' view button.

...and here...

The image shows a Google search interface for Munich, Germany. On the left, a search bar contains the text "Munich, Germany" with a magnifying glass icon and a close button. Below the search bar is a large photograph of the Munich skyline, featuring the red-tiled roof of the Frauenkirche and the spire of St. Peter's Church. A blue button with a white location pin icon and the text "Directions" is positioned to the right of the photo. Below the photo, the text "Munich" is displayed in white, followed by "München" and "Germany" in smaller white text. The weather is shown as "Mostly Cloudy · 11°C" and "1:06 PM". At the bottom of this section are four icons: a bookmark (SAVE), a location pin (NEARBY), a smartphone (SEND TO YOUR PHONE), and a share icon (SHARE).

On the right, a map of Central Europe is shown with a red location pin over Munich. The map labels various cities including Dortmund, Leipzig, Dresden, Cologne, Frankfurt, Nuremberg, Stuttgart, Augsburg, Salzburg, Graz, Vienna, Prague, Brno, Zurich, Liechtenstein, Switzerland, Austria, Milan, Verona, Venice, Padua, Bologna, Genoa, Trieste, and Zagreb. The map also shows the borders of Germany, Czechia, Austria, Switzerland, Slovenia, and Croatia. A scale bar at the bottom right indicates 100 km. At the bottom of the map, there is a "Satellite" button and copyright information: "Map data ©2018 GeoBasis-DE/BKG (©2009), Google, Inst. Geogr. Nacional United Kingdom Terms Send feedback".

At the bottom left of the search results, there is a "Photos" section with two thumbnail images of Munich landmarks. Below the photos is a "Quick facts" section.

...and here...

Salamanca, Spain

Salamanca
Spain

Cloudy · 9°C
1:07 PM

Directions

SAVE NEARBY SEND TO YOUR PHONE SHARE

Photos

Quick facts

Map data ©2018 Google, Inst. Geogr. Nacional, United Kingdom, Terms, and Privacy Policy

...and here...

Cuenca, Ecuador

Cuenca
Ecuador

Light Rain Showers · 13°C
7:08 AM

Directions

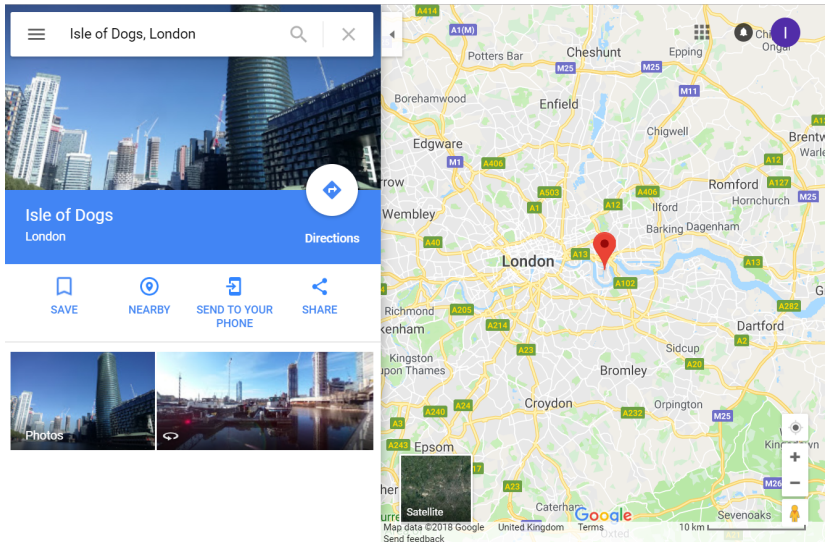
SAVE NEARBY SEND TO YOUR PHONE SHARE

Photos

Quick facts

Map data ©2018 Google United Kingdom Terms Send feedback 200 km

...and here...



...and here...

The image shows a Google search interface for 'Singapore' on the left and a Google Maps view of Malaysia on the right.

Google Search Interface (Left):

- Search bar: Singapore
- Image: A photograph of the Sultan Abdul Aziz Mosque in Singapore.
- Section: Singapore
- Buttons: SAVE, NEARBY, SEND TO YOUR PHONE, SHARE
- Section: Quick facts
- Text: Singapore, an island city-state off southern Malaysia, is a global financial center with a tropical climate and multicultural

Google Maps Interface (Right):

- Map of Malaysia with Singapore highlighted.
- Labels: Malaysia, Kuala Lumpur, PAHANG, Negeri Sembilan, MALACCA, JOHOR, Singapore, RIAU ARCH, RIU, TAMAN BUKIT GAPULUH, JAMBI.
- Map controls: Zoom in (+), Zoom out (-), Street View (person icon), Location (eye icon).
- Map data: ©2018 Google, United Kingdom, Terms, Send feedback, 100 km.

...and the one place on earth I swore I'd never end up was here. (fail)

coventry

Coventry

Partly Cloudy · 8°C
11:59 AM

Directions

SAVE NEARBY SEND TO YOUR PHONE SHARE

Photos

Quick facts

Coventry is a city in central England. It's known for the

Bradley Terry

In the context of tournaments, the probability that team i beats team j is given by

$$P(i \succ j) = \frac{\pi_i}{\pi_i + \pi_j}$$

where π_i is positive-valued, and can be thought of as a parameter reflecting the strength of team i .

Zermelo (1929), Bradley & Terry (1952)

Extension to include ties

$$P(i \succ j) = \frac{\pi_i}{\pi_i + \pi_j + \nu\sqrt{\pi_i\pi_j}}$$

$$P(i \approx j) = \frac{\nu\sqrt{\pi_i\pi_j}}{\pi_i + \pi_j + \nu\sqrt{\pi_i\pi_j}}$$

Davidson (1970)

Extension to account for home advantage (order effects)

$$P(i \succ j) = \frac{\pi_i}{\pi_i + \gamma\pi_j + \nu\sqrt{\pi_i\pi_j}}$$

$$P(i \prec j) = \frac{\gamma\pi_j}{\pi_i + \gamma\pi_j + \nu\sqrt{\pi_i\pi_j}}$$

$$P(i \approx j) = \frac{\nu\sqrt{\pi_i\pi_j}}{\pi_i + \gamma\pi_j + \nu\sqrt{\pi_i\pi_j}}$$

Davidson & Beaver (1977)

Applying to 3 for a win, 1 for a draw

$$P(i \succ j) = \frac{\pi_i}{\pi_i + \pi_j + \nu(\pi_i \pi_j)^{\frac{1}{3}}}$$

$$P(i \approx j) = \frac{\nu(\pi_i \pi_j)^{\frac{1}{3}}}{\pi_i + \pi_j + \nu(\pi_i \pi_j)^{\frac{1}{3}}}$$

See: alt-3.uk

Firth (2017)

Extensions

Q: Wouldn't it be nice if there was a sport with which I was familiar, where the points system was just a bit more complicated?

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A: Rugby union!

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- Q: Wouldn't it be nice if there was a sport with which I was familiar, where the points system was just a bit more complicated, where there was a system of matches that do not make up a full round robin?

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Extensions

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Extensions

Q: Wouldn't it be nice if there was a sport with which I was familiar, where the points system was just a bit more complicated, where there was a system of matches that do not make up a full round robin, and there was an actual tournament based on the results of these matches?

A: Daily Mail Trophy!

Extensions

- Q: Wouldn't it be nice (for me, at least) if there was a sport with which I was familiar, where the points system was just a bit more complicated, where there was a system of matches that do not make up a full round robin, and there was an actual tournament based on the results of these matches, and the methodology they currently use could do with some serious improvement?

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A: Full house!

Rugby union scoring rule

4 points for a win

2 points for a draw

0 points for a loss

1 bonus point for losing by less than seven points

1 bonus point for scoring four or more tries

RASR (pronounced 'razor') - Ranking Algorithm for Schools Rugby

Part one: result outcome

$$P(\text{team } i \text{ beats team } j \text{ by wide margin}) \propto \tau^4 \pi_i^4$$

$$P(\text{team } i \text{ beats team } j \text{ by narrow margin}) \propto \kappa \tau^3 \pi_i^4 \pi_j$$

$$P(\text{team } i \text{ draws with team } j) \propto \nu \pi_i^2 \pi_j^2$$

$$P(\text{team } j \text{ beats team } i \text{ by narrow margin}) \propto \frac{\kappa \pi_i \pi_j^4}{\tau^3}$$

$$P(\text{team } j \text{ beats team } i \text{ by wide margin}) \propto \frac{\pi_j^4}{\tau^4}$$

RASR (pronounced 'razor') - Ranking Algorithm for Schools Rugby

Part two: try bonus outcome

$$P(\text{team } i \text{ and team } j \text{ both gain try bonus point}) \propto \theta\pi_i\pi_j$$

$$P(\text{only team } i \text{ gains try bonus point}) \propto \tau\pi_i$$

$$P(\text{only team } j \text{ gains try bonus point}) \propto \frac{\pi_j}{\tau}$$

$$P(\text{neither team gains try bonus point}) \propto \phi$$

RASR (pronounced 'razor') - Ranking Algorithm for Schools Rugby

Part three: Add a prior

Example Methodological offshoot

A robust mean

$$\mu = \frac{m}{\sum_i \frac{1}{1 + \pi_i}} - 1$$

idea due to David Firth

Areas of potential further study 1

Ranking theory

- Influential edges within B-T ranking
- Investigation of prior
 - ▶ IQR over time
 - ▶ Simulated same ability teams ranking
 - ▶ Empirical similar ability teams ranking
- Home advantage – distance vs fixed
- Extending violations beyond pairwise to sub-tournaments of size >2
- PageRank \approx RASR (Build on David Selby work, if he doesn't want to!)
- B-T explained in terms of moving down parameters of family of loss functions
- Is there an iterative form of LPPM that gives B-T?
- Philosophy of retrodictive vs predictive

Areas of potential further study 2

Ranking applied

- European rugby (website)
- County championship cricket
- Influential liquidity providers in market system
- Time series of citations ranking (the rise of the economists)
- Schools ranking by pupil movements
- University Teaching ranking by pairwise survey comparison
- Using pairwise ranking to improve secular ranking e.g. Thomson Reuters Women
- Soft power index search in one country give website in another
- Twitter influence through Bradley-Terry